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09/280,250	03/29/1999	DAVID ROBERT BALDWIN	TD-147	5503

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EXAMINER
PADMANABHAN, MANO

ART UNIT	PAPER NUMBER
2671	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/280,250	Applicant(s) BALDWIN ET AL.	
	Examiner Mano Padmanabhan	Art Unit 2671	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Status of claims

Claims 1-40 are in the Application.

Claims 1-40 are rejected.

Response to Amendment

Applicants amendments and arguments filed on 2/11/2002 (paper #5) in response to the office action mailed on 7/16/2001 have been fully considered, but they are not persuasive. Therefore, the 35 USC 103 rejections made in the previous office action are maintained, and are restated below with changes as needed to address the amendments/arguments.

Drawings

1. The objection to drawing 4 is hereby withdrawn.

Priority

2. Applicant's claim for domestic priority under 35 U.S.C. 119(e) to the provisional application No. 60/109,733 is hereby acknowledged.

Specification

3. The objection to the title of the invention is hereby withdrawn.

Claim Objections

4. Claim objections to claims 15, and 38-40 hereby withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-5, 7-10, and 33-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huxley (US Patent 5,742,796).

Claim 1 lays claim to a method of rendering 3D graphics comprising the steps of rendering primitives which comprise a graphics display, invoking suspension of reads of pixel information during rendering only selectively, and writing data generated by the rendering step into frame buffer, and outputting data from the frame buffer at video rate.

Huxley teaches a graphics rendering system, containing a video coprocessor (Fig. 3D) connected to a frame buffer for output to a video system, and also teaches a frame buffer interface wherein reads and writes are grouped together to make better utilization of the page structure in memory, and wherein a PreparetoRender message could cause a Suspendreads flag to be set, where there is a chance of stale data being read because rasterization of the next primitive has started, while the writes from the previous primitive are outstanding, and the reads are resumed until all the writes have been completed, and a resume reads signal is set by the Frame Buffer Write unit, teaching that the rendering data is written to the frame buffer (Fig. 2C,

Col.58: lines 7-32). Huxley also teaches that read has priority over writes unless there are outstanding writes queued up, and also teaches that the read returns raw data (pixel data/information). Though Huxley does not explicitly teach suspending of reads of pixel data during rendering of primitives only selectively, Huxley does teach a scenario where the reading of pixel data is suspended while rendering primitives, and the rendering data generated from the pixel data is written into the frame buffer, for display on the display screen(Col.58: lines 13-23). It is also noted that Huxley does teach flagging any potential situations (read write conflicts affecting data integrity (Col.58: lines 7-13), during the rasterization process, and maintaining the integrity of the data. Furthermore, Huxley also teaches suspension of reads by the Frame Buffer Interface Unit, when SuspendReads flag is set indicating potential situations, thus teaching implicitly the selective suspension of reads during the rasterization process. Since such a teaching of selective reads is implicit in Huxley, rendering being part of the rasterization process (Col.15: line 42), it would have been obvious to one of ordinary skill in the art at the time the invention was made, to suspend reading of pixel information during rendering of primitives only selectively (suspend reading of raw data based on certain conditions/events in the system) so that the integrity of the data and the display are not compromised.

Claim 2 adds to claim 1 the step of performing the rendering in at least 4 functionally distinct processing units, allocated to individual rendering operations, connected in a pipeline relationship.

Huxley teaches a long pipeline having 4 functionally distinct processing units, with individual rendering operations (Fig. 2A, Col.6: lines 33-44, Fig.2C, Col.30:lines 35 – Col.31: line 35).

Claim 3 adds to claim 1 the step of using a table of pixel information to determine if reads should be suspended.

Claim 4 adds to claim 1 the step of suspending reads if a primitive being rendered will affect a pixel location which has been previously touched by the rendering of a primitive.

Claim 5 adds to claim 1 a table of pixel information to determine if reads should be suspended, wherein the table comprises a first bit flags all pixels whose information has not yet been updated or discarded, and a second bit that flags pixels which will be affected by the primitive to be rendered.

As per claims 3, 4, and 5, Huxley teaches bit masks (page 43) which cause rasterization to be suspended when certain conditions/events occur (for example SyncOnBitMask, SyncOnHostData). Huxley also teaches suspending read, with the use of a suspend reads flag, when rasterization of the next primitive starts and writes from the previous primitive are still outstanding (Col.58: lines 10-20), and also teaches read/write controls when respective reads and writes are enabled/disabled. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a table of pixels with respective bits set to track all pixels whose information has not yet been updated or discarded, and pixels which will be affected by the primitive to be rendered, since access to data in a table would have been more efficient than setting a flag.

Claim 7 claims a method comprising the steps of performing the rendering in at least 4 functionally distinct processing units, allocated to individual rendering operations, connected in a pipeline relationship, invoking suspension of reads of pixel information during rendering only selectively, and writing data generated by the rendering step into frame buffer, and outputting data from the frame buffer at video rate.

As per claim 7, it is a combination of claims 1 and 2, and hence is rejected with the same rationale.

As per claim 8, it is similar to claim 3, and hence is rejected with the same rationale.

As per claim 9, it is similar to claim 4, and hence is rejected with the same rationale.

As per claim 10, it is similar to claim 5, and hence is rejected with the same rationale.

Claims 33-36 are claims to systems that implement the method of claims 1, 3, 5, and 6 respectively, and hence are rejected with the same rationale.

Claims 37-40 are claims to systems that implement the method of claims 7, 8, 10, and 11 respectively, and hence are rejected with the same rationale. Note that though claims 38-40 recite method claims dependent on independent claim 37 which is a claim for a subsystem, for examining purposes, they have been treated as claims to respective subsystems.

6. Claims 6, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huxley (US Patent 5,742,796), as applied to claim 1 and 7 respectively, and further in view of Wang et al (US Patent 5,831,640).

Claim 6, adds to claim 1 the limitation that the invoking suspension of read is not performed if a primitive to be rendered appears in a history list of recently rendered primitive data.

As per claim 6, it is noted that the invoking step deals with reading pixel data, and selectively suspending reading data during rendering of primitives. The rejection of claim 1, discusses suspension of reads of pixel information during rendering of primitives only selectively, wherein the reads were from buffers (memory). Wang teaches using a cache (memory) controller (table/list), wherein the most recently used texture maps are stored, and the cache miss operations are stored, such that the controller is capable of handling "n" cache miss operations simultaneously. Therefore, if the texture map requested is in the cache (it is in the list of recently used texture maps), it is not fetched, and the missed requests are queued (list), till the number in queue reaches n. When the (n+1)th texture request is encountered, all the requests are processed (Abstract). Similarly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a history list in the invention of Huxley to track the pixels in a table or history list, and do not suspend reads until a write is required to avoid stale data , and then issue suspend read to process all pending writes, and reset the table/history list value, because this will increase process efficiency.

As per claim 11, it is similar to claim 6, and hence is rejected with the same rationale.

7. Claims 12-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huxley (US Patent 5,742,796), in view of Wang et al (US Patent 5,831,640).

Claim 12 claims a method of graphics memory management, comprising the actions of tracking each touched pixel in a table by setting a flag, suspending reads if a pixel that will be touched by a primitive to be rendered is flagged, and clearing flags and resuming reads of pixel information when flagged pixels have been updated/discarded.

As per claim 12, Huxley teaches a graphics rendering system, containing a frame buffer interface wherein reads and writes are grouped together to make better utilization of the page structure in memory, and wherein a PreparetoRender message could cause a Suspendreads flag to be set, where there is a chance of stale data being read because rasterization of the next primitive has started, while the writes from the previous primitive are outstanding, and the reads are resumed until all the writes have been completed, and a resume reads signal is set by the Frame Buffer Write unit, and the suspend reads flag is reset(Col.58: lines 7-32). Huxley also teaches that read has priority over writes unless there are outstanding writes queued up. Huxley, however, fails to teach use of a table to track each touched pixel. Wang teaches using a cache controller (memory management method using table/list), wherein the most recently used texture maps are stored, and the cache miss operations are stored , such that the controller is capable of handling "n" cache miss operations simultaneously. When the (n+1)th texture request is encountered, all the requests are processed (Abstract). Hence, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a table/list in the invention

of Huxley to track the pixels, and do not suspend reads until a write is required to avoid stale data, and then issue suspend read to process all pending writes, and reset the table/history list value, because this will increase process efficiency.

Claim 16 claims a method of graphics memory management, comprising the actions of tracking each touched pixel in a table of 2 bit entries, setting the second bit if a pixel will be touched by a primitive to be rendered, copying the second bit into the first after each primitive is rendered, suspending reads if a first bit entry of a pixel to be rendered is flagged, and clearing flags and resuming reads of pixel information when flagged pixels have been updated/discarded.

As per claim 16, the rationale in the rejection of claim 12 is incorporated here. As per using bits to set flags, Huxley teaches bit masks (page 43) which cause rasterization to be suspended when certain conditions/events occur (for example SyncOnBitMask, SyncOnHostData), and also teaches use of flags for suspend reads and resume reads, etc. . Huxley also teaches suspending read, with the use of a suspend reads flag, when rasterization of the next primitive starts and writes from the previous primitive are still outstanding (Col.58: lines 10-20), and also teaches read/write controls when respective reads and writes are enabled/disabled. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a table of pixels with respective bits set to track all pixels whose information has not yet been updated or discarded, and pixels which will be affected by the primitive to be rendered, since access to data in a table would have been more efficient than setting a flag. As per the step of copying the second bit into the first bit after each primitive is rendered, Wang teaches better cache/memory management by processing multiple requests

simultaneously. It would have been obvious to one of ordinary skill in the art at the time the invention was made to copy the second bit entries into the first bit and start building a new list of updates till a write is required, in order to optimize system efficiency.

Claim 21 claims a method of memory management comprising the steps of keeping a record of each pixel affected by a rendered primitive, removing pixel from record when updated or discarded, and suspending reads if a primitive to be rendered will affect a pixel whose entry remains in said record.

As per claim 21, it is similar to claim 12 with the exception of tracking the pixel in a record here versus a table in claim 12. Since the operations performed on a record or a table are similar, this claim is rejected with the same rationale as claim 12.

Claim 25 claims a method of memory management comprising the steps of tracking each primitive to be rendered, and suspending reads of pixel information if a primitive to be rendered will affect a pixel information that has been previously rendered, but not had sufficient time to be updated.

As per claim 25, the limitations of this claim are a subset of claim 12, and hence this claim is rejected with the same rationale.

As per claims 17, 22, and 26, they are similar to claim 3, and hence are rejected with the same rationale.

As per claims 13, 18, 23, and 27, they are similar to claim 5, and hence are rejected with the same rationale.

As per claim 14, and 19, Huxley discloses addressing pixels by their x,y coordinates (Fig. 6).

As per claim 15, 20, 24, and 28, they are similar to claim 6, and hence are rejected with the same rationale.

8. Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huxley (US Patent 5,742,796), in view of Wang et al (US Patent 5,831,640), and Jenkins (US patent 6,111,582).

Claim 29 claims a method of memory management comprising the steps of assigning a unique ID to each primitive before it is rendered, tracking pixels affected by each primitive to be rendered using the unique ID, and suspending reads of pixel information if a primitive to be rendered will affect a pixel information that has been previously rendered, unless the pixel has been updated.

As per claim 29, the rationale in the rejection of claim 25 is incorporated herein. As per assigning unique identifiers to primitives, and tracking using such identifiers, Jenkins teaches maintaining a list of visible primitives in a global visible primitive array (Col.77: lines 35-65), wherein each primitive is indexed by a unique primitive ID. It would have been obvious to one

ordinary skill in the art at the time the invention was made to assign unique Ids to primitives in Huxley, and track affected pixels using this unique ID, since these Ids can be efficiently used to do a lookup into the table of affected pixels for faster processing.

As per claim 30, it is similar to claim 3, and hence is rejected with the same rationale.

As per claim 31, it is similar to claim 6, and hence is rejected with the same rationale.

As per claim 32, Huxley teaches use of bit flags (bit masks: page 43, which cause rasterization to be suspended when certain conditions/events occur for example SyncOnBitMask, SyncOnHostData) to flag a condition. Huxley also teaches flagging pixels whose information has not yet been updated (suspending read, with the use of a suspend reads flag, when rasterization of the next primitive starts and writes from the previous primitive are still outstanding: Col.58: lines 10-20), and also teaches flagging pixels which will be affected by the primitive to be rendered (read/write controls when respective reads and writes are enabled/disabled: Col.53: lines 15-42). Thus, Huxley teaches bit flags to set conditions for pixel updates, but does not teach use of a table with unique identifiers. As per assigning **unique identifiers** to primitives, and **tracking** using such **identifiers**, Jenkins teaches maintaining a list of visible primitives in a global visible primitive array (Col.77: lines 35-65), wherein each **primitive is indexed by a unique primitive ID**. It would have been obvious to one ordinary skill in the art at the time the invention was made to assign unique Ids to primitives in Huxley, and track affected pixels using this unique ID, since these Ids can be efficiently used to do a lookup into the table of affected pixels for faster processing. As per using a table to track the affected pixels, it would have been obvious to one of ordinary skill in the art at the time the

invention was made, to use a table of pixels with respective bits set to track all pixels whose information has not yet been updated or discarded, and pixels which will be affected by the primitive to be rendered, since access to data in a table would have been more efficient than setting a flag.

Response to Arguments

Applicant's arguments filed 2/11/2002 have been fully considered, but they are not persuasive.

9. **Claim 1** lays claim to a method of rendering 3D graphics comprising the steps of rendering primitives which comprise a graphics display, invoking suspension of reads of pixel information during rendering only selectively, and writing data generated by the rendering step into frame buffer, and outputting data from the frame buffer at video rate.

10. Regarding claim 1, applicants argue that the words "only selectively" are not met. It is noted that while Huxley does not **explicitly** teach **suspending of reads** of pixel data **during rendering** of primitives **only selectively**, Huxley does teach a scenario where **the reading** of pixel data is **suspended** while **rendering** primitives, and the rendering data generated from the pixel data is written into the frame buffer, for display on the display screen (Col.58: lines 18-27). It is also noted that Huxley does teach flagging any potential situations (read write conflicts affecting data integrity (Col.58: lines 7-13), during the rasterization process, and maintaining the integrity of the data, and, contrary to applicants understanding, the examiner has not found

Huxley to be defective in this respect. Furthermore, Huxley also teaches **suspension of reads** by the Frame Buffer Interface Unit, when SuspendReads flag is set indicating potential situations, thus teaching implicitly the **selective suspension of reads** during the rasterization process. Since such a teaching of **selective reads** is implicit in Huxley, rendering being part of the rasterization process (Col.15: line 42), it is the examiners contention that it would have been obvious to one of ordinary skill in the art at the time the invention was made, to **suspend reading of pixel information during rendering of primitives only selectively** (suspend reading of raw data based on certain conditions/events in the system) so that the integrity of the data and the display are not compromised.

The above response applies equally to claims 7 and 37 also.

11. In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

12. **Claim 32** adds to claim 29, a table used to track said pixels with said unique identifier, wherein the table comprises a first bit flags all pixels whose information has not yet been

updated or discarded, and a second bit that flags pixels which will be affected by the primitive to be rendered.

As per claim 32, it is noted that claim 32 is rejected over the combinations of Jenkins with Wang and Huxley. Huxley teaches use of bit flags (bit masks: page 43, which cause rasterization to be suspended when certain conditions/events occur for example SyncOnBitMask, SyncOnHostData) to flag a condition. Huxley also teaches flagging pixels whose information has not yet been updated (suspending read, with the use of a suspend reads flag, when rasterization of the next primitive starts and writes from the previous primitive are still outstanding: Col.58: lines 10-20), and also teaches flagging pixels which will be affected by the primitive to be rendered (read/write controls when respective reads and writes are enabled/disabled: Col.53: lines 15-42). Thus, Huxley teaches bit flags to set conditions for pixel updates, but does not teach use of a table with unique identifiers. As per assigning **unique identifiers** to primitives, and **tracking** using such **identifiers**, Jenkins teaches maintaining a list of visible primitives in a global visible primitive array (Col.77: lines 35-65), wherein each **primitive is indexed by a unique primitive ID**. Since claim 32 is dependent on claim 29, and claim 29 recites the limitation of tracking pixels affected by each primitive using a unique identifier of the primitive, this limitation is considered in the rejection of claim 29, as explained above. It would have been obvious to one ordinary skill in the art at the time the invention was made to assign unique Ids to primitives in Huxley, and track affected pixels using this unique ID, since these Ids can be efficiently used to do a lookup into the table of affected pixels for faster processing. Using a table to track the affected pixels is an additional limitation of claim 32. It would have been obvious to one of ordinary skill in the art at the time the invention was made to

use a table of pixels with respective bits set to track all pixels whose information has not yet been updated or discarded, and pixels which will be affected by the primitive to be rendered, since access to data in a table would have been more efficient than setting a flag.

13. As per applicants concerns regarding some misunderstandings on the part of the examiner, it is noted that the examiner feels that the examiner has understood the invention in the current application, and the prior art cited in the case. However, if the applicants wish to discuss the invention and/or the prior art cited in the case, with the examiner, the applicants are requested to set up an interview for the purpose.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mano Padmanabhan whose telephone number is 703 306-2903. The examiner can normally be reached on Mon-Thurs: 7-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman, can be reached at 703 305-9798.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

Mano Padmanabhan

AU 2671

May 19, 2002